The Food and Feeding Habits of Some Freshwater Fishes of Madras State

BY

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INTRODUCTION

A study of the food and feeding habits of fishes is undoubtedly very important in any fisheries research programme. Recently Hynes (1950) and Pillay (1952) have reviewed the various methods employed in the study of the food of fishes, and Rounsefell and Everhart (1952) have described these different methods in detail.

In 1942, the Indian Council of Agricultural Research sponsored a study on the bionomics of freshwater fishes under the Madras Rural Piscicultural scheme and detailed studies on the food of the economically important species including the 'larvicidal fishes' of the State were undertaken at the Fresh Water Biological Research Station, Madras. An account is given in this paper of the food and feeding habits of half-grown and adult stages of these fishes[1]. In the present study no attempt is made to include food analysis of species collected from 'cultural waters' as the data obtained therefrom differs considerably from that for the same species found in 'natural waters', from where the material for this study was collected.

Mookerjee *et al.* (1946) classified the feeding habits of some fishes on the basis of the presence of the maximum percentage of the types of food in the alimentary canals. From the point of view of the types of food chosen, Kesteven (1946) classified the fishes into herbivorous, carnivorous, and polyphagous and indicated that within these three major groups the fishes should again be classified according to the ecological conditions under which they feed. Ganapati and Chacko (1950) grouped several fishes of piscicultural importance into surface feeders, column feeders, and bottom feeders. This, though useful for general observations, becomes inapplicable while suggesting the combinations of fishes for fish-cultural operations. For instance, it is necessary to differentiate plankton feeders (surface feeders) into phytoplankton and zooplankton feeders when the suitability of a fish as cyclopscidal fish is examined for introduction in a tank. In some

[1] The nomenclature used here is according to Day (1889).

cases, the utility of fish for the eradication of several of the molluscs that act as intermediate hosts for some of the helminth parasites may have to be assessed. In such instances it is necessary that the grouping 'Browsers' be split into various sub-groups according to the taxonomic position of the organisms fed upon. Therefore, it is necessary to classify fishes according to the problems that are tackled, and an outline classification on these lines, followed by descriptive notes is given below:

1. Surface feeders	Plankton feeders (A).
	Insectivores (B).
2. Browsers or bottom feeders	feeding on filamentous algae, molluscs, and worms.
3. Vegetable feeders	feeding on aquatic plants.
4. Column feeders	feeding mostly on larger crustacea, e.g. shrimps and prawns.
5. Piscivores	

Group I—Surface Feeders[1]

This group deals with fishes that feed on plankton and insects:

A. PLANKTON FEEDERS: The typical plankton feeders as determined from the percentage composition of their food (*vide* Table I) can again be split into (*a*) Phytoplankton feeders, and (*b*) Zooplankton feeders.

(*a*) Phytoplankton feeders: Fishes of this group are found to have in their guts food composed of phytoplankton forming about 28 to 68% consisting of the following:

Chlorophyceae: *Ankistrodesmus, Chroococcus, Closterium, Coelastrum, Cosmarium, Crucigenia, Eudorina, Pandorina, Pediastrum,* and *Scenedesmus.*

Myxophyceae: *Merismopedia, Microcystis,* and *Spirulina.*

Diatoms: *Amphora, Coconeis, Cyclotella, Cymbella, Eunotia, Fragillaria, Gomphonema, Melosira, Navicula, Nitzschia, Pinnularia, Rhopalodia, Surirella, Synedra,* and *Tabellaria.*

The following fishes can be grouped under this head:

Barbus amphibius, B. aurelius, B. chola, B. dubius, B. filamentosus, B. sophore, B. ticto, Catla catla, Cirrhina cirrhosa, Labeo boga, Osteocheilus thomassi, Thynnichthys sandkhol, Lebistes reticulatus, and *Macropodus cupanus.*

[1] The analysis of the food of fishes given has been done volumetrically and the percentages of the various groups are hence by volume.

(*b*) Zooplankton feeders: A major percentage of the food of the fishes of this group is made up of zooplanktonic organisms such as:

Copepods: *Cyclops* spp., *Mesocyclops, Pseudodiaptomus* spp., and *Diaptomus* spp.
Protozoans: *Arcella, Difflugia, Phacus, Peridinium,* and *Euglena.*
Rotifers: *Noteus, Diurella,* and *Brachionus.*
Cladocerans: *Diaphanosoma* spp., *Daphnia* spp., *Ceriodaphnia* spp., and *Macrothrix* spp.

The fishes falling under this group are *Ambassis nama, A. ranga, Barbus sarana, B. vittatus,* and *Chela clupeoides.*

B. INSECTIVORES: Of the surface feeders, fishes show preferential feeding habits by taking mainly the insects and their larvae in various stages of metamorphosis, such as *Chironomus,* Ephemeropteran larvae, Dipteran larvae, *Plea, Notonecta, Corixa, Ranatra, Odonata* larvae, and *Cybister* and other water beetles. From an examination of the food (Table II) the following fishes can be classified as mainly insectivorous:

Anabas scandens, Barilius bakeri, B. bendelisis, Chela argentea, C. bacaila, C. untrahi, Danio aequipinnatus, Rasbora daniconius, Etroplus maculatus, Gambusia affinis, and *Aplocheilus lineatus.*

Group II—Browsers or Bottom Feeders

The fishes feeding on filamentous algae, molluscs, and worms and those in whose stomachs sand grains in fair proportion are found have all been placed under this group (*vide* Table III). Generally, the filamentous algae are found in shallow areas or attached to rocks and such other anchorages at the margins. The mollusca are often seen on the algae or on the submerged stones. In view of these ecological conditions, fishes having in their stomachs a good percentage of filamentous algae have also been placed along with the typical bottom feeders.

The main composition of the diet of the fishes of this group is as follows:

Filamentous algae: *Gleotrichia, Lyngbia, Nostoc, Oedogonium, Oscillatoria, Spirogyra,* and *Ulothrix.*
Molluscs: *Melanoides tuberculatus,* and *Indoplanorbis exustus.*
Worms: *Nais.*

Fishes under this head are *Barbus carnaticus, B. stigma, Cirrhina reba, Labeo boggut, L. calbasu, L. fimbriatus, L. kontius, Nuria danrica, Lepidocephalus thermalis, Pangasius pangasius, Ophiocephalus punctatus,* and *Etroplus suratensis.*

Group III—Vegetable Feeders

Fishes classified under this group are found to have their diet composed mainly of the higher aquatic plants, dead leaves and seeds of land plants, and other vegetable debris (Table IV).

The following fishes can be placed under this group *Barbus hexagonolepis, B. curmuca,* and *Osphronemus goramy.*

Group IV—Column Feeders

Under this are grouped those fishes that are found to be feeding on the faster moving and larger crustaceans like shrimps (*Caridina*).

Only *Barbus chrysopoma* has been found to be feeding mainly on the larger crustaceans and is classified as a typical column feeder (*vide* Table V).

Group V—Piscivores

Lastly are the fish that are found to be feeding predominantly on fish (*vide* Table VI). Both young and adolescent fish have been found in their gut contents. The piscivores have been observed to select advantageous positions in natural waters to capture fish that try to swim rapidly below anicuts and regulators.

The following fishes can be classified as typical piscivores:

Notopterus notopterus, Callichrous macrophthalmus, C. pabda, Macrones seenghala, Saccobranchus fossilis, Silonia silonia, Wallago attu, Glossogobius giuris, Gobius biocellatus, and *Ophiocephalus striatus.*

Application of data on Food and Feeding Habits to Fish Culture

Ganapati and Chacko (1950) while making suggestions for stocking fish ponds in Madras stated that one of the problems of fish farm management is 'to work on the combination of species that will produce the maximum yield of edible fish for each type of pond'. The composition of such combinations will vary depending on the types of available food items. 'So a pond should be stocked with surface feeders, column feeders, and bottom feeders to get maximum production. As a general rule, it is advisable to stock a pond with 50% of fingerlings of surface feeders, 25% of column feeders, and with 25% of bottom feeders'. These proportions are based on the fact that the region of biological productivity is confined to the regions of photosynthesis and that the bottom region is the zone of biological reduction. The same authors have suggested various combinations with respect to the types of food available in various types of tanks.

Apart from food, many of these fishes can be utilised from the point of view of public health. Many waters emit a foul odour when having blooms of some algae. The blue-green alga *Microcystis*, is one that gives rise to such periodical blooms creating very foul odour. *Cirrhina cirrhosa, Labeo boggut,* and *Barbus dubius* are good for a very successful combating of these blooms. Very thick growths of *Hydrila, Oscillatoria,* and *Spirogyra* have been successfully cleared by *Tilapia mossambica, Labeo calbasu,* and *Catla catla* in the Chetput Fish Farm. The importance of food and feeding habits data on fishes becomes very apparent when their usefulness for control of water-borne diseases is examined. Thus *Gambusia affinis, Aplocheilus lineatus, Rasbora daniconius,* and *Etroplus maculatus* have been used very successfully for the control of mosquito larvae and *Ambassis ranga, A. nama,* and *Chela clupeoides* have proved to be very good cyclopscidal fishes. Chacko and Kuriyan (1949) observed the occurrence of large numbers of molluscs in the stomachs of *Catla catla.* The culture of this carp in rural waters may help the control of molluscs which are the intermediary hosts of many of the helminth parasites.

Most of the piscivores can be very well used for a successful fish culture in swamps, rock quarry pools, and tanks where net fishing is a problem and line fishing alone is possible.

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PERCENTAGE COMPOSITION OF THE FOOD GROUPS IN THE GUT CONTENTS OF THE FRESHWATER FISHES OF MADRAS

Name of fish	Number of specimens examined	Unicellular algae	Filamentous algae	Higher plants	Protozoans	Copepods	Crustaceans	Insects	Fish	Molluscs	Worms	Mud and sand	Amphibians
(1) (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Table I—Plankton feeders													
1. *Ambassis nama*	210	0.2	—	—	16.4	45.8	16.1	21.3	—	—	—	0.2	—
2. *A. ranga*	230	0.4	—	—	10.1	46.9	25.7	16.5	—	—	—	0.4	—
3. *Barbus amphibius*	260	62.0	18.0	—	—	12.0	1.0	5.0	—	—	—	2.0	—
4. *B. aurelius*	311	32.0	24.0	4.0	6.0	13.0	—	15.0	—	—	—	6.0	—
5. *B. chola*	250	68.0	12.0	—	—	12.0	4.0	—	—	—	—	4.0	—
6. *B. dorsalis*	210	37.5	15.0	—	6.0	11.6	8.3	20.0	—	—	1.6	—	—
7. *B. dubius*	136	29.1	24.1	—	1.0	12.5	2.0	17.2	—	12.1	—	2.0	—
8. *B. filamentosus*	175	28.0	22.0	—	—	24.0	8.0	10.0	—	—	—	8.0	—
9. *B. sarana*	150	5.3	8.0	—	16.6	21.6	—	8.6	20.0	16.6	—	3.3	—
10. *B. sophore*	250	44.0	24.0	—	—	16.0	2.0	10.0	—	—	—	4.0	—
11. *B. ticto*	270	34.0	25.0	—	—	20.0	3.0	10.0	—	—	—	8.0	—
12. *B. vittatus*	145	32.0	18.0	—	—	34.0	1.0	8.0	—	—	—	7.0	—
13. *Catla catla*	1,500	28.0	10.0	30.0	5.0	10.0	10.0	—	—	3.0	—	4.0	—
14. *Chela clupeoides*	134	4.0	2.0	—	2.0	58.0	16.0	18.0	—	—	—	—	—
15. *Cirrhina cirrhosa*	360	52.0	19.0	—	8.0	14.0	7.0	—	—	—	—	—	—
16. *Labeo boga*	110	39.0	22.0	—	8.0	15.0	12.0	—	—	—	—	4.0	—
17. *Lebistes reticulatus*	440	30.0	15.0	—	5.0	10.0	10.0	27.0	—	—	3.0	—	—
18. *Macropodus cupanus*	320	35.0	20.0	—	5.0	—	20.0	15.0	—	—	—	5.0	—
19. *Osteocheilus thomassi*	176	60.0	5.0	—	10.0	20.0	—	—	—	5.0	—	—	—
20. *Thynnichthys sandkhol*	184	50.0	12.0	—	10.0	18.0	10.0	—	—	—	—	—	—

Table II—Insectivores

1.	*Anabas scandens*	185	—	2.0	13.0	—	—	10.5	40.5	14.0	19.0	—	1.0	—
2.	*Aplocheilus lineatus*	413	22.0	—	—	9.0	11.0	—	58.0	—	—	—	—	—
3.	*Barilius bakeri*	164	5.0	5.0	—	—	5.0	10.0	70.0	—	5.0	—	—	—
4.	*B. bendelisis*	128	8.0	10.0	2.0	1.0	10.0	13.0	46.0	—	8.0	1.0	1.0	—
5.	*Chela argentea*	527	15.0	10.0	—	5.0	12.0	3.0	55.0	—	—	—	—	—
6.	*C. bacaila*	213	3.4	9.2	—	—	—	—	64.6	22.8	—	—	—	—
7.	*C. untrahi*	385	4.0	3.0	—	3.0	22.0	2.0	66.0	—	—	—	—	—
8.	*Danio aequipinnatus*	440	16.6	20.8	8.3	—	8.5	—	45.6	0.2	—	—	—	—
9.	*Etroplus maculatus*	450	6.6	5.6	1.6	2.0	28.2	1.0	31.0	—	—	24.0	—	—
10.	*Gambusia affinis*	610	25.0	15.0	—	—	10.0	5.0	45.0	—	—	—	—	—
11.	*Rasbora daniconius*	400	25.0	7.0	12.0	3.0	8.0	—	40.0	—	—	5.0	—	—

Table III—Browsers or bottom feeders

1.	*Barbus carnaticus*	225	14.4	39.2	31.5	—	—	1.1	11.3	0.5	—	—	2.0	—
2.	*B. stigma*	313	15.0	55.0	—	2.0	18.0	8.0	2.0	—	—	—	—	—
3.	*Cirrhina reba*	423	18.0	54.0	6.0	10.0	9.0	—	3.0	—	—	—	—	—
4.	*Etroplus suratensis*	576	28.0	44.0	2.0	5.0	4.0	3.0	2.5	0.5	—	1.0	10.0	—
5.	*Labeo boggut*	100	25.0	56.0	—	—	—	—	—	—	—	—	19.0	—
6.	*L. calbasu*	176	11.0	33.0	28.0	3.0	3.0	6.0	3.0	—	2.0	—	11.0	—
7.	*L. fimbriatus*	610	26.0	38.0	—	—	1.0	4.0	3.0	—	—	—	28.0	—
8.	*L. kontius*	214	21.0	16.0	19.0	—	4.0	3.0	9.0	—	—	6.0	22.0	—
9.	*Lepidocephalus thermalis*	250	25.0	65.0	—	3.0	—	2.0	—	—	—	—	5.0	—
10.	*Nuria danrica*	234	30.0	40.0	—	—	7.0	3.0	12.0	—	—	—	8.0	—
11.	*Ophiocephalus punctatus* ..	418	—	—	—	—	—	—	25.0	5.0	20.0	30.0	20.0	—
12.	*Pangasius pangasius*	175	—	1.6	10.7	—	—	2.3	18.2	31.8	35.4	—	—	—
13.	*Tilapia mossambica*	433	21.0	52.0	12.0	0.3	5.1	3.4	—	0.1	—	—	6.0	—

Table IV—Vegetable feeders

1.	*Barbus curmuca*	232	10.0	23.0	38.0	6.0	3.0	9.0	5.0	—	—	6.0	—	—
2.	*B. hexagonolepis*	375	7.1	5.3	45.1	1.2	—	2.6	26.1	0.6	7.0	0.2	5.0	—
3.	*Osphronemus goramy*	267	3.0	15.0	60.0	—	—	8.0	7.0	—	—	7.0	—	—